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For the attention of Examiner P. Batev

URGENT

Dear Sirs

International Patent Application No. PCT/GB2004/002983
Chapter II PCT
Hewlett-Packard Development Company, L.P.
Our ref: 200300817-2 WO

Thank you for the written opinion dated 10th August 2005.

Embodiments of the present invention relate to forming a cross-over of a first elongate conductive interconnect (north-south in the figures) and a second elongate conductive interconnect (east-west in the figures). The base layer of the conductive interconnects is formed in figure 1B by the anisotropic electro-deposition of metal 110 onto the passivated conductive carrier 102 using insulating material 106 as a mask. A "tombstone" of dielectric material 122 is deposited over the first conductive interconnect where it will be crossed over by the second conductive interconnect as shown in figure 1C. Then electro-deposition of metal 124 occurs on at least exposed portions 110a, 110b of the second conductive interconnect. The metal goes up and over the tombstone and meets to form a cross-over. A further layer of metal 126 may be electro-deposited. The interconnect structure is then "flip" transferred onto a flexible plastic substrate 114 and removed from the conductive carrier 102 to form the structure in figure 1F.

An important aspect of embodiments of the invention is the connection of the two conductive portions 110a, 110b by an electro-deposited bridge 126 over the tombstone 122. The bridge 126 physically contacts the conductive portions 110a, 110b. The current claims use the terminology "physically interconnecting". This is intended to mean that the bridge contacts the underlying conductive elements i.e. it physically connects to them as opposed to electrically connects to them. Embodiments of the invention have the advantage that they do not require a two-stage process for forming the bridge as in the prior art.

Our understanding of the Examiner's comments under point 1 of the office action is that although there is no exact textual support in the application as originally filed for "physically interconnecting", the introduction of this term into the claim is nevertheless supported and does not add subject matter. For example, it is a direct and inevitable result of depositing metal on the first metal portion 110a and the second metal portion 110b to meet over the insulating material 112 and form the metal layer 124, that the metal layer 124 physically interconnects the first and second metal portions (page 7, lines 19 to 21).

The Examiner states that the wording of the claim does not exclude an interconnection formed in two steps – electroplating and etching. The Examiner incorrectly asserts that this two-step process is disclosed in the prior art document.

The formation of a cross-over is illustrated in figure 6 and referred to at column 4, lines 40 to 47 of US 4159222 (D1). This section states "a second layer printed circuit pattern 62 may then be formed atop the surfaces 58 and 60 by any suitable process. For example, a complete layer of copper may be plated and then selectively etched to leave the desired circuit pattern. Alternatively, a thin layer of copper may be electroless deposited upon the surfaces 58 and 60 and electro-plated to a thickness of about 0.1 mil."

Therefore in D1, in one embodiment, a copper blanket is plated and then etched. However, the copper blanket is not described as electro-deposited. There is no direct and unambiguous disclosure of the electro-deposition of a metal layer followed by its etching.

In D1, in a second embodiment, a seed layer is used for electroplating. It is the seed layer that contacts the conductive portions, not the electro-plated layer. The current claims use the terminology "physically interconnecting". This means that the bridge contacts the underlying conductive elements i.e. it physically connects to them as opposed to electrically connects to them. As the seed layer in D1 intervenes between the electro-plated layer and the underlying layer, the electro-plated layer cannot physically interconnect to the underlying layer.

For the foregoing reasons it will be readily understood that the independent claims define features of the invention that are novel over the prior art D1.

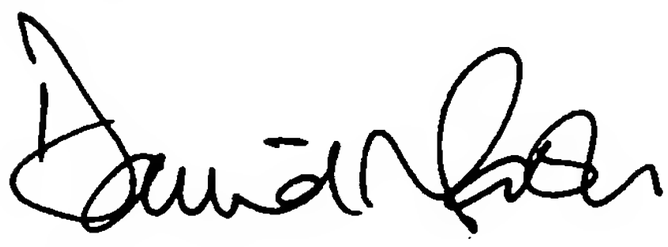
Embodiments of the invention provide an improved method of forming a cross-over and thus an improved cross-over itself. There is nothing in the prior art that would motivate a person skilled in the art to adapt the teaching in D1 to arrive at the present invention.

It appears that in D1 two different alternatives are presented for very good reasons. The prior art teaches that if electro-plating is to be used, then electroless deposition of an electrode must occur first. If electroless deposition is to be avoided, then plating of the metal is used instead of electro-plating. There is nothing in the prior art that suggests or teaches how to electro-deposit metal without the need to form an electroless seed layer. The invention is therefore not obvious and involves an inventive step.

The Examiner at point 2 indicates subject matter that he considers to be allowable. D1 does not disclose either isotropic electrolytic deposition or anisotropic electrolytic deposition. The feature that the bridge is formed by substantially isotropic electrolytic deposition of metal directly on the first and second metal portions (to form layer 124) is therefore itself novel. This feature is already recited in claim 34.

In view of the above, we look forward to receiving a favourable examination report.

Yours faithfully



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